International Journal of Engineering & Technology, 8 (1.10) (2019) 96-101

International Journal of Engineering & Technology

Website: www.sciencepubco.com/index.php/IJET

Research paper

The Application of Interpretive Structural Modeling Technique (ISM) to Study Adopting model of Green Supply Chain Management

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Abstract

Environmental concern has increasingly become an important issue in supply chain management. Firms would gain competitive advantage by adopting green supply chain management. However, green supply chain management will work effectively and efficiently if the firm's human resource department plays a major role in creating the awareness and the value of adopting the concept of green. Hence, the objective of this study was to investigate the relationships among all the relevant elements/variables concerning green supply chain management and the role of human resource department in the organization. We adopted the ISM technique to examine the relationships among those elements/variables derived from the literature review, group discussion, and in-depth interviews. Additionally, group discussion and in-depth interviews were also adopted to examine the relationships among those elements/variables. The results were satisfactory and the relationships among those key elements/variables were established. Thus, the ISM technique is very useful in research and the relationships derived in this study are considered robust.

Keywords: *ISM technique, GSCM, Supply Chain Management, Green Training, Human Resource*

1. Introduction

Green supply chain management (GSCM) is adopted to enhance the economic and environmental performance of the organization (Klassen & Johnson, 2004; Srivastava, 2007; Chiou et al., 2011; Schrettle et al., 2014). It can be applied to reduce the use of raw materials and waste from the production/manufacturing/service providing processes. GSCM helped reduce the use of hazardous raw materials in the production process which, in turn, helped enhance the economic performance of the organization (Zhu et al., 2008; Zhu, Sarkis & Lai, 2012).

Green Supply Chain (GSC) practices are managerial approaches to improve the firm's performance as well as to reduce environmental impact from the firm's operations (Zhu, Sarkis & Lai, 2012; Zhu, Sarkis & Lai, 2013). GSC consists of five main components, i.e., internal environmental management (Yu et al., 2014; Zhan et al., 2016), Green procurement (Hsu et al., 2013; Hokey & William, 2001). collaboration with customers (Zhu, Sarkis & Lai, 2008), eco-design, and investment recovery (Green, Whitten & Inman, 2012; Zhu et al., 2008). Previous research has shown a positive influence of these five key components on firms' performance (Choi & Hwang, 2015; Jabbour et al., 2014; Zhan et al., 2016). However, GSCM requires the firm's human resource (HR) department to make an arrangement for staff training in the organization so that all the employees at all levels will have a better understanding of how the operations of GSCM work (Catherine, 2011).

In this research, we adopted the interpretative structural model (ISM) as a systematic tool to develop a practical structural/research model . The structural model generated by this technique would be based on the actual GSCM procedures involving newly invented variables associated with green training (Sushil, 2012)

2. Literature Review

ISM is a qualitative and interpretative method that corrects complex and unclear variables by mapping complex structures into an understandable model .The model derived from the ISM method depends on the context and the type of relationships .It is a systematic way of identifying the hierarchy of relationships in each step (Sanjay, & Ravi, 2005; Singh et al., 2003; Thakkar et al., 2005).

The steps for the ISM approach can be described as follows:

1. Selecting the elements/variables that are involved in the problem .The starting point is to select elements/variables that are relevant to the problem .
2. Performing contextual relationship classification. This step is to classify contextual relationships and assign a possible relationship for each variable with other variables.

3. Structuring a self-interaction matrix)SSIM .(This is to compare the relationships of individual elements/variables .In this process, it is the obligation of the experts to identify the relationship of each pair of elements/variables) such as i and j (by identifying the symbols .These symbols are described below.
V -for a relationship from i to j but not in both directions
A -for a relationship from j to i but not in both directions
X -for directional relationships, both from i to j and j to i, and O -if there is no relationship between elements/variables.
4. Create a metrix of relationships .This step is obtained by identifying the relationship symbols between the variables using the attribute to represent the relationship, i.e., the number 0 and the number 1.
- If the item) i, j (in SSIM is V, then the item) i,j (in reachability metrix become 1 and the item) j, i (becomes 0.
- If the item)i, j (in SSIM is A then the item) i, j (in reachability metrix becomes 0 and the item) j, i (becomes 1.
- If the item) i, j (in SSIM is X, then both items) i, j (and)j, i (of reachability matrix are 1
- If the item)i, j (of SSIM is O, then both items)i, j (and)j, i (of reachability matrix become 0.

Also, the assumption in relation to each pair of elements/variables in the ISM technique is that if A constitutes B and B is related to C, it may infer that A is involved in C, and if in reachability matrix (i, j) has a relationship of 0, there is no direct or indirect relationship between the elements/variables (i, j) at the beginning of the matrix generation access (i, j) is not directly or indirectly related .The value specified in the metrix will be 0.
5. Divide the level of reachability metrix .This step is involved in the extraction of the hierarchy of an element/variable's relationship from the reachability matrix .
6 .Draw the structural model derived from the order of elements/variables.

2.1 Symbol and definition of variables

Upon the literature review, group discussion, and in-depth interviews, we identified the following elements/variables that would be used in the ISM technique.

External factors
- Supplier relationship (C1) Supplier relationship is referred to as the integration of connection between partners which contributes to the exchange of information and resources (Hsu et al., 2013; Kuei et al., 2015; Laari et al., 2016).
- Customer pressure (C2) Customer pressure basically refers to the requirement of the relevant stakeholders, particularly distributors/customers to adopt green supply chain practices (Hsu et al., 2013; Kuei et al., 2015; Laari et al., 2016).
- Competitor pressure (C3) Competitor pressure is defined as the businesses that produce and sell the same products to the same market (Hsu et al., 2013; Kuei et al., 2015; Laari et al., 2016).

Internal factors
- Managerial support (C4) Managerial support is referred to as the assistance given by top management of the firm in terms of resources in support of the operational activities (Helfat & Peteraf, 2003; Hart, 1995).
- OCBE (C5) Organizational citizenship behavior toward the environment (OCBE) means the recognition of individual behavior involved in the management of the firm's assets (Helfat & Peteraf, 2003; Hart, 1995).

GSCM procedures
- Internal environmental management (C6) Internal environmental management is referred to as the system consisting of a series of environmental policies within the organization (Yu et al., 2014; Hsu et al., 2013).
- Green procurement (C7) Green procurement refers to the process of supplying raw materials to the production (Hsu et al., 2013; Zhu, Sarkis & Lai, 2008; Jabbour et al., 2014).
- Customer's collaboration (C8) Customer's collaboration refers to the cooperation with distributors/customers by corresponding with standards to exchange technical and other relevant information (Hsu et al., 2013; Zhu, Sarkis & Lai, 2008; Jabbour et al., 2014).
- Eco -design (C9) Eco -design is a concept concerning eco-friendly practices, such as green design, sustainable design, etc. (Zhu et al., 2008; Green, Whitten & Inman, 2012).
- Investment recovery (C10) Investment recovery means the process of seeking and selling the outdated and surplus assets that are unnecessary to make sure that those are outdated and not environmentally friendly assets (Zhu et al., 2008; Green, Whitten & Inman, 2012).
- Green training (C11) Green training is referred to as the integration between human resource management and environmental management (Bonnie & Suchun, 2001).

Performances
This paper classified performance into two main dimensions, economic and environmental performance.
- Economic performance (C12) Economic performance refers to the measurement of the achievement of the firm in terms of economic objectives that include sales, profits, costs, etc. (Klassen & Johnson, 2004; Zhu, Sarkis & Lai, 2008).
- Environmental performance (C13) Environmental performance is referred to as the measurement of the achievement of the firm in terms of environmental objectives (Klassen & Johnson, 2004; Zhu, Sarkis & Lai, 2008).

3. Methodology

The identified thirteen elements/variables described above were used in the analysis by using the ISM technique. We selected ten experts who had experience in GSCM. These experts consisted of both practitioners and scholars (Thakkar et al., 2005)
The next step is to develop structural self-interaction matrix (SSIM) to illustrate the direction of the relationships among those identified elements/variables by using the symbols V, A, X, O.
V-The enabler i improve to achieve enabler j.

A-The enabler j improve to achieve enabler i.
X -The enablers i and j improve to achieve each other.
O -The enablers i and j are unrelated .

4. Result and Discussion

The results of performing the ISM technique can be described below in the form of both tables and figures.

Table 1: Structural self-interaction matrix (SSIM)

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
C1	1	A	A	A	O	V	V	O	X	V	V	V	V
C2		1	O	V	V	V	V	V	V	V	V	V	V
C3			1	V	V	V	V	V	V	V	O	V	O
C4				1	V	V	V	V	V	V	V	V	V
C5					1	V	V	O	A	X	A	O	V
C6						1	O	O	V	A	A	O	V
C7							1	O	A	V	X	V	V
C8								1	O	O	V	V	V
C9									1	X	V	V	A
C10										1	V	V	V
C11											1	O	X
C12												1	A
C13													1

Table 1 is a structural self- interaction matrix (SSIM) which is the initial step of performing the ISM . The table 1 showed the relationships among the thirteen elements/variables of the supplier relationship management (SRM). The next step is to prepare a full matrix based on the principle of developing the initial reachability matrix shown above.

Table 2: Initial reachability matrix

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
C1	1	0	0	0	0	1	1	0	1	1	1	1	1
C2	1	1	0	1	1	1	1	1	1	1	1	1	1
C3	1	0	1	1	1	1	1	1	1	1	0	1	0
C4	1	0	0	1	1	1	1	1	1	1	1	1	1
C5	0	0	0	0	1	1	1	0	0	1	0	0	1
C6	0	0	0	0	0	1	0	0	1	0	0	0	1
C7	0	0	0	0	0	0	1	0	0	1	1	1	1
C8	0	0	0	0	0	0	0	1	0	0	1	1	1
C9	0	0	0	0	1	0	1	0	1	1	1	1	0
C10	0	0	0	0	1	1	0	0	1	1	1	1	1
C11	0	0	0	0	1	1	1	0	0	0	1	0	1
C12	0	0	0	0	0	0	0	0	0	0	0	1	0
C13	0	0	0	0	0	0	0	0	1	0	1	1	1

In Table 2, the initial reachability matrix is derived by changing the relationships among elements/variables by using the number 0 and 1 . This table was derived first before getting to the next table. The Table 3 is prepared by considering the transitivity. This approach was taken into account to establish the relationships among those elements/variables. If an element A leads to element B and if element B leads to element C, according to the rule of transitivity, we conclude that A leads to C. Basically, it means that if A leads to B and B leads to C, then A lags to C. By performing this step, the next reachability matrix is derived. The next table showed those zeros relevant to the transitivity in the bold and italic format .

Table 3: Initial reachability matrices with transitivity

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13
C1	1	0	0	0	0	1	1	0	1	1	1	1	1
C2	1	1	0	1	1	1	1	1	1	1	1	1	1
C3	1	0	1	1	1	1	1	1	1	1	***0***	1	***0***
C4	1	0	0	1	1	1	1	1	1	1	1	1	1
C5	0	0	0	0	1	1	1	0	0	1	0	0	1
C6	0	0	0	0	0	1	0	0	1	0	0	0	1
C7	0	0	0	0	0	0	1	0	0	1	1	1	1
C8	0	0	0	0	0	0	0	1	0	0	1	1	1
C9	0	0	0	0	1	***0***	1	0	1	1	1	1	***0***
C10	0	0	0	0	1	1	***0***	0	1	1	1	1	1
C11	0	0	0	0	1	1	1	0	***0***	***0***	1	0	1
C12	0	0	0	0	0	0	0	0	0	0	0	1	0
C13	0	0	0	0	0	0	0	0	1	***0***	1	1	1

Table 4 is the inter-relationships of all elements/variables .The next step is to sum each row to get the driving power and to sum each column to get the dependence .The driving power and dependence need to classify into four clusters, namely autonomous, dependent, linkage, and independent .These four clusters are determined by the antecedent set and reachability set .These two sets will determine the intersection set .Tables are prepared for each one (Table 5, Table 6, Table 7, Table 8, Table 9, Table 10, Table 11, and Table 12).

MICMAC analysis technique identified the variables according to their driving power and dependent power. It classified variables into four clusters, driving, linking, dependent, and autonomous factors.Figure 1 displays the structural model derived from the ISM technique whereas Figure 2 describes the relationship between dependence power and driving power. The X-axis in Figure 2 shows the dependence power while the Y-axis shows the driving power.

Table 4: Final reachability matrix

	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	Driving power
C1	1	0	0	0	0	1	1	0	1	1	1	1	1	8
C2	1	1	0	1	1	1	1	1	1	1	1	1	1	12
C3	1	0	1	1	1	1	1	1	1	1	**1**	1	**1**	12
C4	1	0	0	1	1	1	1	1	1	1	1	1	1	11
C5	0	0	0	0	1	1	1	0	**0**	1	**0**	**0**	1	5
C6	0	0	0	0	0	1	0	0	1	**0**	**0**	**0**	1	3
C7	0	0	0	0	0	0	1	0	0	1	1	1	1	5
C8	0	0	0	0	0	0	0	1	0	0	1	1	1	4
C9	0	0	0	0	1	**1**	1	0	1	1	1	1	**1**	8
C10	0	0	0	0	1	1	**1**	0	1	1	1	1	1	8
C11	0	0	0	0	1	1	1	0	**1**	**1**	1	0	1	7
C12	0	0	0	0	0	0	0	0	0	0	0	1	0	1
C13	0	0	0	0	0	0	0	0	1	**1**	1	1	1	5
Dependence	4	1	1	3	7	9	9	4	9	10	10	10	12	

Table 5: The relationship of reachability and antecedent set to the intersection set.

Variable	Reachability set	Antecedent set	Intersection set	Level
C1	1,6,7,9,10,11,12,13	1,2,3,4	1	
C2	1,2,4,5,6,7,8,9,10,11,12,13	2	2	
C3	1,3,4,5,6,7,8,9,10,11,12,13	3	3	
C4	1,4,5,6,7,8,9,10,11,12,13	2,3,4	4	
C5	5,6,7,10,13	2,3,4,5,9,10,11	5,10	
C6	6,9,13	1,2,3,4,5,6,9,10,11	6,9	
C7	7,10,11,12,13	1,2,3,4,5,7,9,10,11	7,10,11	
C8	8,11,12,13	2,3,4,8	8	
C9	5,6,7,9,10,11,12,13	1,2,3,4,6,9,10,11,13	9,10,11,13	
C10	5,6,7,9,10,11,12,13	1,2,3,4,5,7,9,10,11,13	5,7,9,10,11,13	
C11	5,6,7,9,10,11,13	1,2,3,4,7,8,9,10,11,13	7,9,10,11,13	
C12	12	1,2,3,4,7,8,9,10,12,13	12	I
C13	9,10,11,12,13	1,2,3,4,5,6,7,8,9,10,11,13	9,10,11,13	

Table 6: ISM table

Variable	Reachability set	Antecedent set	Intersection set	Level
C1	1,6,7,9,10,11,13	1,2,3,4	1	
C2	1,2,4,5,6,7,8,9,10,11,13	2	2	
C3	1,3,4,5,6,7,8,9,10,11,13	3	3	
C4	1,4,5,6,7,8,9,10,11,13	2,3,4	4	
C5	5,6,7,10,13	2,3,4,5,9,10,11	5,10	
C6	6,9,13	1,2,3,4,5,6,9,10,11	6,9	
C7	7,10,11,13	1,2,3,4,5,7,9,10,11	7,10,11	
C8	8,11,12,13	2,3,4,8	8	
C9	5,6,7,9,10,11,13	1,2,3,4,6,9,10,11,13	9,10,11,13	
C10	5,6,7,9,10,11,13	1,2,3,4,5,7,9,10,11,13	5,7,9,10,11,13	
C11	5,6,7,9,10,11,13	1,2,3,4,7,8,9,10,11,13	7,9,10,11,13	
C13	9,10,11,13	1,2,3,4,5,6,7,8,9,10,11,13	9,10,11,13	II

Table 7: ISM table

Variable	Reachability set	Antecedent set	Intersection set	Level
C1	1,6,7,9,10,11	1,2,3,4	1	
C2	1,2,4,5,6,7,8,9,10,11	2	2	
C3	1,3,4,5,6,7,8,9,10,11	3	3	
C4	1,4,5,6,7,8,9,10,11	2,3,4	4	
C5	5,6,7,10	2,3,4,5,9,10,11	5,10	
C6	6,9	1,2,3,4,5,6,9,10,11	6,9	III
C7	7,10,11	1,2,3,4,5,7,9,10,11	7,10,11	III
C8	8,11	2,3,4,8	8	
C9	5,6,7,9,10,11	1,2,3,4,6,9,10,11	9,10,11	
C10	5,6,7,9,10,11	1,2,3,4,5,7,9,10,11	5,7,9,10,11	
C11	5,6,7,9,10,11	1,2,3,4,7,8,9,10,11	7,9,10,11	

Table 8: ISM table

Variable	Reachability set	Antecedent set	Intersection set	Level
C1	1,9,10,11	1,2,3,4	1	
C2	1,2,4,5,8,9,10,11	2	2	
C3	1,3,4,5,8,9,10,11	3	3	

C4	1,4,5,8,9,10,11	2,3,4	4	
C5	5,10	2,3,4,5,9,10,11	5,10	IV
C8	8,11	2,3,4,8	8	
C9	5,9,10,11	1,2,3,4,9,10,11	9,10,11	
C10	5,9,10,11	1,2,3,4,5,9,10,11	5,9,10,11	IV
C11	5,9,10,11	1,2,3,4,8,9,10,11	9,10,11	

Table 9: ISM table

Variable	Reachability set	Antecedent set	Intersection set	Level
C1	1,9,11	1,2,3,4	1	
C2	1,2,4,8,9,11	2	2	
C3	1,3,4,8,9,11	3	3	
C4	1,4,8,9,11	2,3,4	4	
C8	8,11	2,3,4,8	8	
C9	9,11	1,2,3,4,9,11	9,11	V
C11	9,11	1,2,3,4,8,9,11	9,11	V

Table 10: ISM table

Variable	Reachability set	Antecedent set	Intersection set	Level
C1	1	1,2,3,4	1	VI
C2	1,2,4,8	2	2	
C3	1,3,4,8	3	3	
C4	1,4,8,	2,3,4	4	
C8	8	2,3,4,8	8	VI

Table 11: ISM table

Variable	Reachability set	Antecedent set	Intersection set	Level
C2	2,4	2	2	
C3	3,4	3	3	
C4	4	2,3,4	4	VII

Table 12: ISM table

Variable	Reachability set	Antecedent set	Intersection set	Level
C2	2	2	2	VIII
C3	3	3	3	VIII

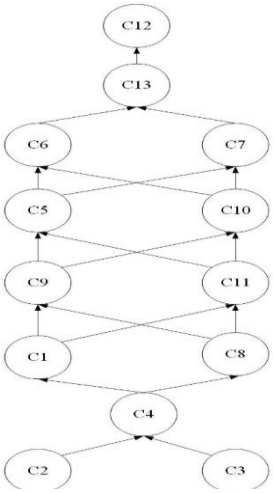

Figure 1: Structural model derived from the ISM technique

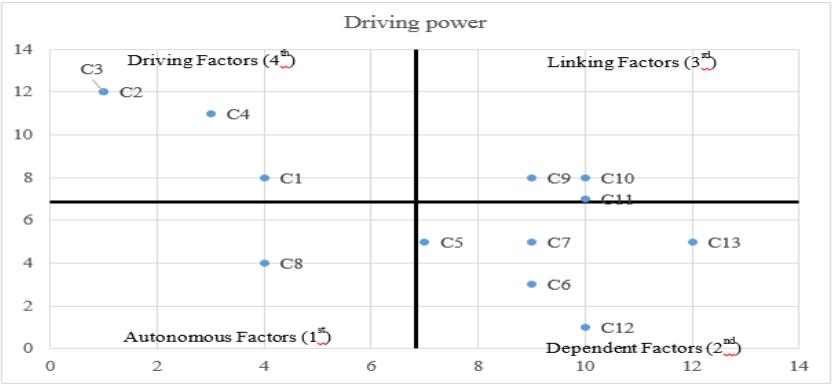

Figure 2: The X-axis shows the dependence power and the Y-axis shows the driving power.

This research also applied Micmac analysis technique, its result present as figure2. Four variables identified as driving factors, supplier relationship (C1), customer pressure (C2), competitor pressure (C3), and managerial support (C4). Action on the driving factors will effect on other variables except the variable as autonomous factors. Five variables classified as dependent factors, OCBE (C5), internal environment management (C6), green procurement (C7), economic performance (C12), and environment performance (C13). The dependent factors will effect by driving and linking factors. Three variables recognized as linking factors, eco-design (C9), investment recovery (C10), and green training (C11). The linking factors having strong dependence and strong or weak driving power, this mean these factor will be change by driving factors or effect on dependent factors. Customer collaboration (C8) presented as anonymous factor, this has lower dependent and also has lower driving force.

5. Conclusion

This study was aimed at investigating the relationships among all the relevant elements/variables concerning green supply chain management and the role of human resource department in the organization. We adopted the ISM technique to examine the relationships among those elements/variables derived from literature review, group discussion, and in-depth interviews. Additionally, group discussion and in-depth interviews were also used to examine the relationships among those elements/variables. The results were satisfactory. The relationships among those key elements/variables were firmly established. These relationships were derived from those experts in the field of green supply chain management. Hence, the ISM technique is a very useful technique in modern research and the relationships derived are considered robust.

References

[1] Bonnie, F .D., & Su-chun, H) .2001 .(Achieving sustainability through attention to human resource factors in environmental management . International Journal of Operations & Production Management, 21)12(, 1539-1552 .

[2] Catherine, G) .2011 .(Reaping the benefits of environmental awareness :how organizations are engaging their employees .Development and Learning in Organizations :An International Journal, 25)2(, 18-20 .

[3] Chiou, T-.Y., Chan, H .K., Lettice, F., & Chung, S .H) .2011 .(The influence of greening the suppliers and green innovation on environmental performance and competitive advantage in Taiwan .Transportation Research Part E :Logistics and Transportation Review, 47)6(, 822-836 .

[4] Choi, D., & Hwang, T) .2015 .(The impact of green supply chain management practices on firm performance :the role of collaborative capability . Operations Management Research, 8, 69-83 .

[5] Green, K .W., Whitten, D., & Inman, R .A) .2012 .(Aligning marketing strategies throughout the supply chain to enhance performance .Industrial Marketing Management, 41)6(, 1008-1018 .

[6] Hart, S .L) .1995 .(A Natural-Resource-Based View of the Firm .The Academy of Management Review, 20, 986-1014.

[7] Helfat, C .E., & Peteraf, M .A) .2003 .(The dynamic resource-based view :capability lifecycles .Strategic Management Journal, 24)10(, 997-1010 .

[8] Hokey, M., & William, P .G) .2001 .(Green procurementpractices of US firms .International Journal of Operations & Production Management, 21)9(, 1222-1238 .

[9] Hsu, C-.C., Tan, K .C., Zailani, S .H .M., & Jayaraman, V) .2013 .(Supply chain drivers that foster the development of green initiatives in an emerging economy .International Journal of Operations & Production Management, 33, 656-688 .

[10] Jabbour, A .B .L .d .S., Jabbour, C .J .C., Latan, H., Teixeira, A .A., & de Oliveira, J .H .C) .2014 .(Quality management, environmental management maturity, green supply chain practices and green performance of Brazilian companies with ISO 14001 certification :Direct and indirect effects .Transportation Research Part E :Logistics and Transportation Review, 67, 39-51.

[11] Klassen, R., & Johnson, F) .2004 .(The green supply chain, in Understanding Supply Chains :Concepts, critiques and futures, ed SJ New and R Westbrook, pp 229–51 .Oxford :Oxford University Press.

[12] Kuei, C-.h., Madu, C .N., Chow, W .S., & Chen, Y) .2015 .(Determinants and associated performance improvement of green supply chain management in China .Journal of Cleaner Production, 95, 163-173 .

[13] Laari, S., Töyli, J., Solakivi, T., & Ojala, L) .2016 .(Firm performance and customer-driven green supply chain management .Journal of Cleaner Production, 1960-1970 .

[14] Sanjay, J., & Ravi, S) .2005 .(IT-enablement of supply chains :understanding the barriers .Journal of Enterprise Information Management, 18)1(, 11-27.

[15] Schrettle, S., Hinz, A., Scherrer -Rathje, M., & Friedli, T) .2014 .(Turning sustainability into action :Explaining firms' sustainability efforts and their impact on firm performance .International Journal of Production Economics, 147)Part A(, 73-84 .

[16] Singh, M. D., Shankar, R., Narain, R., & Agarwal, A. (2003) .An interpretive structural modeling of knowledge management in engineering industries .Journal of Advances in Management Research, 1)1(, 28-40 .

[17] Srivastava, S .K) .2007 .(Green supply-chain management :A state-of-the-art literature review .International Journal of Management Reviews, 9)1(, 53-80 .

[18] Sushil, S) .2012 .(Interpreting the Interpretive Structural Model .Global Journal of Flexible Systems Management, 13)2(, 87-106 .

[19] Thakkar, J., Deshmukh, S .G., Gupta, A .D., & Shankar, R) .2005 .(Selection of Third-Party Logistics)3PL :(A Hybrid Approach Using Interpretive Structural Modeling)ISM (and Analytic Network Process)ANP .(Supply Chain Forum :An International Journal, 6)1(, 32-46 .

[20] Yu, W., Chavez, R., Feng, M., & Wiengarten, F) .2014 .(Integrated green supply chain management and operational performance .Supply Chain Management :An International Journal, 19)5/6(, 683-696 .

[21] Zhan, Y., Tan, K .H., Ji, G., Chung, L., & Chiu, A .S .F) .2016 .(Green and lean sustainable development path in China :Guanxi, practices and performance .Resources, Conservation and Recycling .

[22] Zhu, Q., Sarkis, J., & Lai, K .–h) .2013 .(institional-based antecedents and performance outcomes of internal and external green supply chain management practices .Journal of Purchasing and Supply Management, 19)2(, 106-117.

[23] Zhu, Q., Sarkis, J., & Lai, K-.h) .2008 .(Confirmation of a measurement model for green supply chain management practices implementation . International Journal of Production Economics, 111)2(, 261-273 .

[24] Zhu, Q., Sarkis, J., & Lai, K-.h) .2012 .(Examining the effects of green supply chain management practices and their mediations on performance improvements .International Journal of Production Research, 50)5(, 1377-1394 .

[25] Zhu, Q., Sarkis, J., Cordeiro, J .J., & Lai, K-.H) .2008 .(Firm-level correlates of emergent green supply chain management practices in the Chinese context .Omega, 36)4(, 577-591 .